

CLAIMS

1. A machine for handling tubular knitted articles, such as socks or the like, with a first end and a second end, comprising:

- at least one tubular member to transport the articles;
- a container in which said articles are randomly disposed;
- pick-up members to pick up individual articles from said container;
- a feed path of the articles;
- detection means to identify the orientation of the articles along said path;
- a stretching device to stretch open an end of an article and load said article onto said tubular member;

characterized in that it also comprises members to discard articles oriented with the first end farther forward than the second end with respect to the direction of feed of the article along said path, and to feed toward said stretching device articles oriented with the second end farther forward than the first end with respect to said direction of feed.

2. Machine as claimed in claim 1, wherein said first end and said second end are respectively the toe and the elastic band of the tubular knitted article.

3. Machine as claimed in claim 1, wherein said first end and said second end are respectively the band and the toe of the tubular knitted article.

4. Machine as claimed in one or more of the previous claims, wherein said pick-up members are multiple.

5. Machine as claimed in claim 4, wherein said detection means are multiple.

6. Machine as claimed in one or more of the previous claims, wherein said detection means are disposed along a trajectory of said pick-up members, said pick-up members being controlled to hold the articles oriented with the second end being the leading end and release into the container articles oriented with the first end being the leading end.

7. Machine as claimed in claim 6, wherein said pick-up members are provided with a vertical movement, said detection means being disposed along the vertical trajectory of said pick-up members.

8. Machine as claimed in one or more of claims 1 to 5, comprising along said feed path a conveyor, on which the articles picked up from said

container by mean of said pick-up members are disposed, and wherein said detection means are disposed along said conveyor.

9. Machine as claimed in one or more of the previous claims, comprising a recirculation path, which extends from a position along said feed path towards said container.

10. Machine as claimed in claims 8 and 9, wherein said recirculation path extends from a position along said conveyor toward said container.

11. Machine as claimed in claim 9 or 10, wherein said recirculation path is a pneumatic path.

10 12. Machine as claimed in one or more of the previous claims, comprising a storage buffer for said articles, between the pick-up members and said stretching device.

13. Machine as claimed in one or more of the previous claims, comprising a plurality of tubular members, disposed and controlled to pass 15 through a plurality of stations.

14. Machine as claimed in claim 13, wherein said tubular members are supported by a rotating assembly.

15. Machine as claimed in claim 14, wherein said rotating assembly rotates about a vertical axis.

20 16. Machine as claimed in claim 13, 14 or 15, comprising a loading station, wherein said stretching device is disposed.

17. Machine as claimed in claim 16, wherein disposed in said loading station is at least one pair of retaining elements of the elastic band of the articles, movable in relation to each other, so that they can move toward 25 and away from each other, said retaining elements engaging the elastic band of said tubular article to open it and prepare it to be picked up by said stretching device.

18. Machine as claimed in claims 4 and 17, wherein disposed in said loading station are at least two pairs of retaining elements of the elastic 30 band of the articles, each associated with a respective pick-up member.

19. Machine as claimed in claim 18, wherein said stretching device is positionable to cooperate alternately with one or with the other of said at least two pairs of retaining elements of the elastic band of the articles.

20. Machine as claimed in one or more of claims 17 to 19, wherein

said pair or pairs of retaining elements of the elastic band of the articles are mounted on an oscillating arm to take a first position to engage the elastic band and a second position to present the elastic band to said stretching device.

5 21. Machine as claimed in one or more of claims 17 to 20, wherein the pick-up members are disposed so that each article picked up is fed between the two retaining elements of said at least one pair.

10 22. Machine as claimed in one or more of claims 17 to 21, wherein said retaining elements of the elastic band of the articles are at least in part suction elements.

23. Machine as claimed in one or more of claims 16 to 22, wherein said loading station comprises a reversing device, to reverse the tubular articles.

15 24. Machine as claimed in one or more of claims 13 to 22, comprising a reversing station of the tubular articles, wherein a reversing device is disposed to reverse the tubular articles.

20 25. Machine as claimed in claim 23 or 24, wherein said reversing device comprises at least one suction tube and one stretching member, said stretching member transferring the elastic band of the article onto the suction tube.

26. Machine as claimed in one or more of claims 13 to 25, comprising an orientation station of the tubular article to position a pocket of fabric of said tubular article in a specific angular position with respect to the tubular member over which it is inserted.

25 27. Machine as claimed in claim 26, wherein said orientation station comprises: at least one sensor positionable at the side of said tubular member in proximity to an end edge of said tubular member and suitable to detect the fabric of the tubular article; and an actuator to rotate the tubular member and said at least one sensor with respect to each other about the 30 axis of the tubular member, a control unit being provided and programmed to determine the angular position of the tubular article on the basis of the signal of said sensor.

28. Machine as claimed in claim 26 or 27, comprising a retaining member of the tubular article and means to rotate the article with respect to

the tubular member or vice versa about the axis of the tubular member.

29. Machine as claimed in one or more of the previous claims, comprising a station to pick-up and transfer the tubular article to a rectilinear guide, said station comprising a pick-up member provided with a plurality of engaging elements of the toe of the article, disposed about the axis of the tubular member positioned in the pick-up and transfer station, and which have a variable geometry to take alternately a circular or polygonal configuration and an essentially rectilinear flattened configuration.

30. Machine as claimed in claim 29, wherein said engaging elements are divided into a first series of elements and a second series of elements, in said flattened configuration the engaging elements of the two series taking a position wherein they are adjacent and opposite each other, with the toe of the article disposed therebetween in a flattened and essentially rectilinear configuration, the edge of the toe being divided into two edge portions aligned with and adjacent to each other.

31. Machine as claimed in claim 29 or 30, wherein said pick-up member comprises at least one actuator to carry the engaging elements alternately to a flattened position and to an annular or polygonal position surrounding the axis of the loading member.

32. Machine as claimed in one or more of the previous claims, wherein said tubular members comprise extractable stretching means, to stretch the toe of the article, which impose a polygonal configuration on the toe of the article inserted over the tubular member.

33. Machine as claimed in claim 32, wherein said stretching means of the toe comprise a plurality of tabs, essentially parallel to the axis of the tubular member.

34. Machine as claimed in claim 32 or 33, wherein said stretching means are disposed and designed to impose a quadrangular configuration on the toe of the article, preferably rectangular and especially square.

35. Machine as claimed in claim 33 or 34, comprising four engaging elements of the toe of the article, coordinated with four extractable tabs.

36. Machine as claimed in one or more of claims 32 to 35, wherein said stretching means are movable parallel to the axis of the tubular member to transfer the toe of the article from the tubular member to the engaging

— elements of the toe.

37. Machine as claimed in one or more of claims 29 to 36, wherein said pick-up member has a plurality of needles designed and arranged to engage respective portions of the toe of the article.

5 38. Machine as claimed in claim 37, wherein extractors are associated with said needles to withdraw the article from the needles.

39. Machine as claimed in one or more of claims 29 to 38, wherein each of said engaging elements comprises a plate provided with a plurality of pick-up means of the toe of the article.

10 40. Machine as claimed in claims 33 and 39, wherein when the engaging elements are disposed in the polygonal configuration, each plate is disposed between two consecutive tabs.

41. Machine as claimed in claim 39 or 40, wherein said pick-up means are constituted by needles.

15 42. Machine as claimed in claim 39 or 40 or 41, wherein said plates are hinged to each other about axes essentially parallel to the axis of said tubular member.

20 43. Machine as claimed in claim 42, wherein said pick-up means of each plate are aligned according to a direction orthogonal to the hinge axes with which the respective plate is connected to the adjacent plate.

44. Machine as claimed in one or more of claims 41 to 43, wherein said needles are movable orthogonally to the respective plate.

45. Machine as claimed in claim 44, wherein each plate is provided with a plurality of holes inside which said needles penetrate.

25 46. Method to feed tubular knitted articles having a first end and a second end to a work station, comprising the steps of:

- picking up individual articles from a plurality of articles disposed randomly in a container;
- feeding the articles along a feed path toward a work station;
- for each article, determining which of said first and said second end is the leading end along said path, with respect to the direction of feed;
- feeding the articles oriented with the second end being the leading end to said work station and discarding the articles which are oriented with the first end being the leading end.

47. Method as claimed in claim 46, wherein said discarded articles are returned toward said container.

48. Method as claimed in claim 46 or 47, wherein said first end is a toe to be closed of said articles and said second end is an elastic band.

5 49. Method as claimed in claim 46 or 47, wherein said first end is an elastic band and said second end is a toe to be closed.

50. Method as claimed in one or more of claims 46 to 49, comprising the step of creating a storage magazine of articles along said feed path.

10 51. Method as claimed in one or more of claims 46 to 50, wherein in said work station each article is positioned on a tubular transport member.

52. Method as claimed in claims 48 and 51 or 49 and 51, wherein each article is positioned on the tubular transport member stretching the elastic band of said article and inserting the toe to be sewn of the article over 15 the end of said tubular member.

53. Method as claimed in claim 52, comprising the steps of:

- stretching said article over said tubular member so that an intermediate part of a band surrounding said toe is disposed along a line intersecting in two points the end edge of the tubular member and the remaining part is disposed along the outside surface of the tubular member;
- detecting the angular position of said band on the tubular member;
- identifying the angular position of a pocket of fabric on the basis of the angular position of said band with respect to the tubular member.

54. Method as claimed in claim 53, characterized by the steps of:

- 25 - determining the angular positions of two portions of said band adjacent to the end edge of the tubular member and disposed on the outside surface of said tubular member;
- identifying the angular position of the pocket of fabric in the intermediate area between said two angular positions.

30 55. Method as claimed in claim 53 or 54, comprising the steps of:

- disposing the tubular knitted article with the toe in an open configuration;
- engaging a first border of the edge of the toe in a plurality of positions and a second border of the edge of the toe in a further plurality of positions;
- placing the first border and the second border of the edge adjacent to

each other to give the toe an essentially rectilinear flattened configuration.

56. Method as claimed in claim 55, wherein said open toe is disposed in a polygonal configuration wherein consecutive portions of the edge of the toe are disposed approximately according to the sides of a polygon, and wherein each side of said polygon is engaged by a respective engaging element, the sides of the polygon being aligned so that the toe takes said essentially rectilinear flattened configuration.

57. Method as claimed in claim 56, wherein said polygon is a quadrangle, preferably a rectangle, and even more preferably a square.

10 58. Method as claimed in claim 56 or 57, wherein the toe of the article is withdrawn from the tubular member maintaining the polygonal configuration, and subsequently the sides of the polygon are engaged by respective engaging elements and aligned to take the essentially rectilinear flattened configuration.

15 59. Method as claimed in one or more of claims 56 to 58, wherein the article is inserted in a rectilinear guide or guillotine.